STEAM BESTPRACTICE RESOURCES AND TOOLS: "OLD" NEWS IS "NEW" NEWS!

Dr. Anthony Wright
Technical Support,
Steam BestPractices
Oak Ridge National Laboratory

Fred Hart
Co-Manager,
Steam BestPractices
U.S. Dept. of Energy
Office of Industrial Technologies

Christopher Russell
Co-Manager,
Steam BestPractices
Alliance to Save Energy

David Jaber
Research Associate
Alliance to Save Energy

ABSTRACT

The U.S. Department of Energy Office of Industrial Technology (DOE-OIT) BestPractice efforts aim to assist U.S. industry in adopting near-term energy-efficient technologies and practices through voluntary, technical assistance programs on improved system efficiency. The Steam BestPractice effort, a part of the DOE-OIT effort, has identified and documented an extensive group of steam system resources and tools to assist steam system users to improve their systems. This paper describes the "new" news that Steam BestPractices is assembling from the "old" news about opportunities and techniques to improve steam systems.

INTRODUCTION

In his 1947 classic text "The Efficient Use of Steam," Sir Oliver Lyle noted that:

"There are three fundamental things, and three only, that should guide our steam economy, and we should strive after them with might and main:

(1) Prevent the escape of heat.
(2) Reduce the work to be done.
(3) Use the heat over again." (1)

More than 50 years later, Sir Lyle's "old" news is being translated into "new" news in a national effort to improve the U.S. industrial economy through improvements to industrial process steam systems.

The U.S. Department of Energy (DOE) Office of Industrial Technology (OIT) BestPractice efforts aim to assist U.S. industry in adopting near-term energy-efficient technologies and practices through voluntary, technical assistance programs on improved system efficiency. There are nine industry groups - designated Industries of the Future (IOFs) - that are the focus of the OIT efforts. These IOFs include Agriculture, Aluminum, Chemicals, Forest Products, Glass, Metal Casting, Mining, Petroleum, and Steel. BestPractice efforts cover motors, compressed air, steam, and combined heat and power systems.

The overall goal of the BestPractice efforts is to assist steam users in adopting a systems approach to designing, installing and operating boilers, distribution systems, and steam applications. Steam BestPractices is led by the DOE-OIT and the Alliance to Save Energy, and is supported by a Steering Committee of steam system users, steam system service providers, and relevant trade associations.

One of the major 1999 goals of the Steam BestPractices effort was to identify and document an extensive group of steam system resources and tools. There were three main objectives in identifying and documenting these tools and resources:

1. To create an information base to "make the case" for the opportunities available to significantly enhance industrial steam systems;

2. To identify resources to assist steam system users to improve their steam systems; and

3. To identify what new resources and tools can be created to assist steam system users in the future.

This paper describes the outstanding "new" news that is being created from "old" news by Steam BestPractices.

TECHNICAL TOOLS AND INFORMATION

Technical References and Technical Tools

Two types of steam system technical information have been collected:

1. A listing of available Steam System Technical References and Standards; and

2. A listing of available Steam System Technical Tools.

The members of the Steam BestPractices Steering Committee and Subcommittees provided information on key references and tools that they used in their work or that they knew about. This information was assembled and put onto the Steam BestPractice web site for future use by steam system users and service providers. A summary of the information collected is noted below:

1. A list of 82 Steam Technical References and Standard documents has been compiled. These documents have been categorized on the web site under the categories of Generation, Distribution, End Use, Recovery, and Total Steam System. The listing provides the document name, author, and a brief description of the document.

2. A list of 66 Steam Technical Tools has also been compiled. The Technical Tools have been categorized on the web site under the categories of Diagnostic Equipment (11), Guidelines (19), and Software Products (36).

Steam Tips

An Energy Saving **TIP** is a brief (typically one page) writeup of a Best Practice - including a description, an example application, and suggested actions for applying the improvement opportunity.

The Georgia Tech Industrial Energy Extension Service developed a series of Steam Tip fact sheets. During the past year, Steam BestPractices has adapted the Georgia Tech Steam Tip sheets and has now published ten of these:

- Inspect and Repair Steam Traps
- Insulate Steam Distribution and Condensate Return Lines
- Use Feedwater Economizers for Waste Heat Recovery
- Improve Your Boiler's Combustion Efficiency
- Quantify and Eliminate Steam Leaks
- Clean Boiler Fire-side Heat Transfer Surfaces
- Clean Boiler Water-side Heat Transfer Surfaces
- Return Condensate to the Boiler
- Minimize Boiler Blowdown
- Recover Heat from Boiler Blowdown

These Steam Tips can be printed and/or downloaded from the Steam BestPractices web site.

NAIMA 3E-Plus Insulation Software

The North American Insulation Manufacturers Association (NAIMA) 3E-Plus software program quantifies the economic thickness of an insulation application through heat flow calculations, and estimates greenhouse gas reductions resulting from insulation improvements. An IBM-PC DOS version of this program is available from our web site; and a new Windows version is anticipated in the near future.

Energy Efficiency Handbook

The Council of Industrial Boiler Operators (CIBO) developed an Energy Efficiency Handbook. This handbook was prepared to help steam system owners and operators to get the best energy-efficient performance out of their steam systems. The handbook provides information and helpful operational tips on many aspects of steam system operation, including Water Treatment, Boiler Operations and Controls, Heat Recovery, and Cogeneration. The Energy Efficiency Handbook can be obtained from the Steam BestPractice web site.

BEST PRACTICES AND CASE STUDIES

A **BEST PRACTICE** is a preferred and/or excellent way of performing an activity.

A **CASE STUDY** is a detailed description of an industrial project that produced energy savings, economic benefit, etc.

Documenting new and presently available Best Practices and Case Studies is one of the best ways to create awareness about opportunities for improving industrial steam systems.

Documenting New Case Studies

During the past year, Steam BestPractices has collaborated with the following organizations to document their recent steam system improvement efforts in the form of case study writeups:

- Chemical Manufacturer's Association (CMA), 1997 Energy Efficiency Award Winners
- Mobil Energy Management
- Bethlehem Steel
- Georgia Pacific
- Babcock and Wilcox
- Texas Instruments

These case studies are developed by: a) obtaining initial information about the improvement effort from individual companies; b) reviewing the information to verify that the stated energy savings are realistic; c) preparing draft case studies for review; and d) revising and finalizing the case study writeups.

Table 1 summarizes some of the annual savings that have been achieved in the industrial case studies that we have documented to date. The information in the table illustrates that significant steam system energy improvements and cost savings are possible, with short paybacks, from improvements that many steam users could make to their steam systems.

Detailed case study writeups for the efforts summarized in Table 1 are available on our web site.

Available Best Practice, Case Study Information

There are numerous reports and articles published in trade publications, technical journals, and conference proceedings documenting available Steam System Best Practices and Case Studies. We have initiated an effort to document available Best Practice and Case Study publications; we obtained this information primarily from members of our Steering Committee.

Table 1. Summary of Selected Steam Case Study Improvement Results

Company[a]	Brief Description of Steam Improvement Made	Annual Savings ($)	Simple Payback (years)
Nalco	Reduce steam header pressure.	$142,000	minimal
Vulcan Chemicals	Reduce steam pressure in distillation columns.	$42,000	minimal
Mobil, Mary Ann Gas	Improve steam system control scheme.	$400,000	minimal
Mobil, Nigeria	Install additional steam traps on drum oven.	≥$50,000	0.1
Velsicol Chemical	Improve steam trap maintenance program.	$100,000	≤ 0.2
Texas Petrochemical	Replace faulty compressor turbine, and reconfigure steam and cooling systems.	$2,300,000	≤ 0.25
Georgia Pacific	Insulate steam lines, replace faulty steam traps.	$138,560	0.5
Texas Instruments	Replace existing steam boiler system, improve plant heat recovery.	$1,303,500	1
Bethlehem Steel	Rebuild and upgrade steam turbine.	$3,300,000	1
Babcock and Wilcox	Install new boiler combustion controls, replace more than 90% of system steam traps.	$250,000	≤ 1.5

[a] Nalco, Vulcan, Velsicol, and Texas Petrochemical are CMA Energy Efficiency Award winners.

At the present time, we have documented 40 available Best Practice publications and 18 available Case Study publications on our web site. We have identified the information source for each document (for example, a reprint from a trade magazine), the application in the steam system for the document, and the purpose of the Best Practice or Case Study. Additional best practices and case studies can be submitted on-line through the web site.

TRAINING

The Steam BestPractices Training Subcommittee initiated an effort to identify steam training courses available in the U.S. Prior to this effort, the extent of available steam training in the U.S. was not known. This was not an effort to endorse particular training programs over others.

The Training Subcommittee has now identified an extensive list of available steam training courses, and this list is documented on our web site. At the present time, we are aware of 80 steam training courses that are being provided by 31 different organizations.

One outcome of identifying available steam training is that there appears to be a need for operator training and/or training guidelines for operating and maintaining boiler systems. Based on this identified need, the National Board of Pressure Vessel Inspectors is in the process of developing an operator course.

AWARENESS RESOURCES

The Awareness Resources listed below (available at no cost) have been developed to assist steam system users and service providers to obtain the "new" news from the Steam BestPractice efforts.

Web site

All of the technical resource and tool information assembled by BestPractices related to steam systems is available on our web site at:

www.oit.doe.gov/steam.

In addition, information on resources and tools that are available for the overall DOE-OIT effort is available from the following web address:

http://www.oit.doe.gov/techdeliv.shtml

Clearinghouse

Through Washington State University, a Clearinghouse has been set up that can be contacted to obtain OIT BestPractice publications and technical assistance on steam system related questions. The contact information for the Clearinghouse is:

Phone: (800) 862-2086
Email: steamline@energy.wsu.edu

Steaming Ahead Newsletter

Each month, BestPractices publishes this on-line newsletter (available on the web site) to provide information on activities being performed, future steam system workshops and conferences, and other information of interest to the steam system user and service provider community.

Energy Matters Newsletter

Energy Matters is a bimonthly OIT publication that focuses on energy savings opportunities for motor, steam, compressed air, and combined heat and power systems. It is available by subscription for free; information on subscribing to Energy Matters is available from the DOE-OIT web site or through the Clearinghouse.

Steam Awareness Workshops

BestPractices has conducted steam awareness workshops designed to make steam users aware of the opportunities available to improve their steam systems. Most of the workshops have been co-sponsored by the Alliance to Save Energy and a steam service provider. Typical formats for these workshops have included:

1. Presentations on the BestPractice efforts and opportunities to improve industrial steam systems;
2. Presentations on other energy and productivity improvements available through government and private sources; and
3. Steam user presentations on specific improvements they have made to their process systems.

More than a dozen of these workshops have successfully been conducted, and we plan to conduct at least this many additional workshops this year.

FUTURE RESOURCES AND TOOLS

BestPractices is developing additional resources and tools to assist steam users. Major resources and tools under development are described below.

Steam System Opportunity Assessment

A major industrial steam system market assessment has recently been initiated by DOE-OIT. The Steam System Opportunities Assessment will have four major objectives:

1. To develop baseline information on U.S. process industry steam generation, use, and opportunities for steam system improvements;
2. To identify steam system design, maintenance, and management practices presently used by U.S. process industry;
3. To develop a methodology to assess the effectiveness of efforts to influence U.S. industry to improve their steam system operations; and
4. To educate and influence industry and government decision makers on the benefits that can be realized from steam system efficiency improvements.

This effort will establish parameters describing the industrial market for steam efficiency improvements. It is anticipated that the Opportunity Assessment will take one to two years to complete.

Steam Systems Sourcebook

BestPractices is developing a Steam Systems Sourcebook to increase awareness of energy saving opportunities in industrial steam systems. The Sourcebook is intended to increase awareness of energy efficiency opportunities among plant engineers, facility managers, and system operators.

The Sourcebook will contain three main sections:

1. A "Steam Basics" section that will describe the fundamentals of steam system operation;
2. A "Fact Sheet" section that will provide greater details regarding specific steam system performance improvement opportunities; and
3. A "Where to Find Help" section that will describe where steam system users can obtain further information to assist their system improvement efforts.

The Sourcebook will be published and available for use in mid-2000.

Steam System Survey Guidelines

BestPractices is developing a set of Steam System Survey Guidelines for use by steam system users. The specific audience for these guidelines will be users who are not sure how to initiate a steam system improvement program. The Survey Guidelines will cover the following topical areas:

1. Steam System Profiling (how much steam do you use, how much are your fuel costs, how does improved boiler efficiency translate to saved costs, etc.).
2. Steam Generation.
3. Steam Distribution and Losses.
4. Steam Utilization.

Each section of the guidelines will include discussion of improvement opportunities and examples that users can follow to quantify the possible improvements in their individual systems. These Guidelines will be finalized and available for use in mid-2000.

CONCLUSIONS

In developing a comprehensive set of steam system resources and tools, BestPractices could not have said it any better than Sir Oliver Lyle did:

> "ALL thermal devices deserve investigation, deserve a careful estimate of their probable cost, and deserve a conscientious calculation of the return they may bring." (1)

BestPractices is committed to developing tools and resources to help steam system users create "new" news of energy and productivity improvements in their process steam systems.

REFERENCES

1. Oliver Lyle, **The Efficient Use of Steam**, Her Majesty's Stationery Office, 1947.